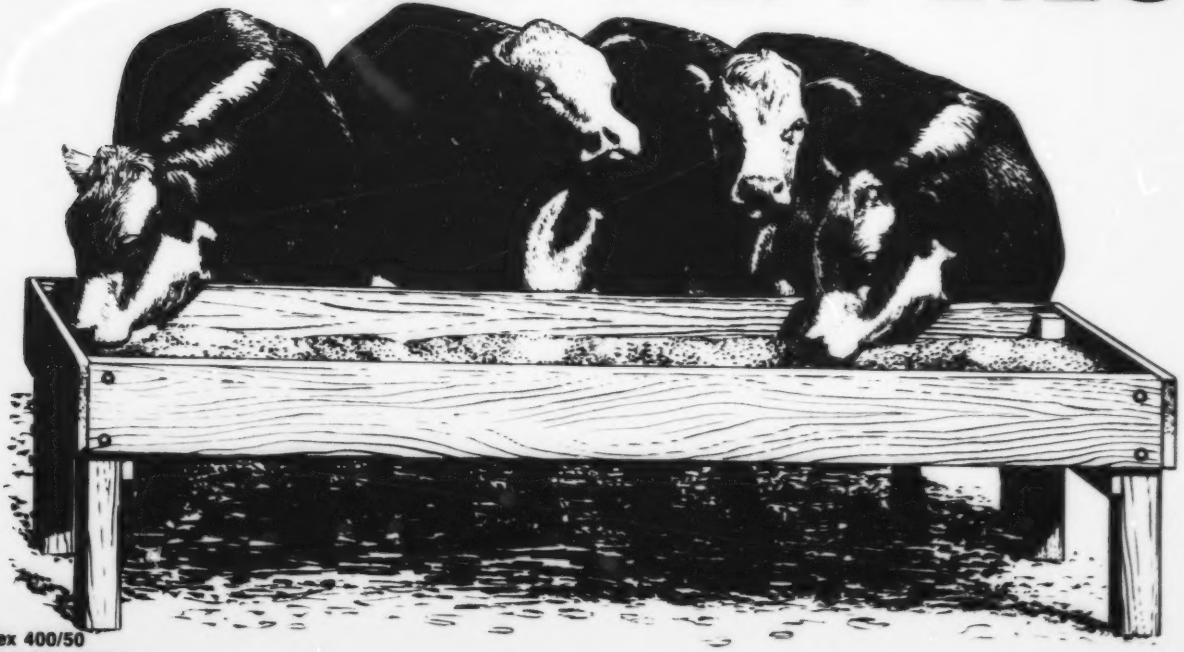
Manitoba
Agriculture

EXTENDING LIVESTOCK FEED SUPPLIES



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EXTENDING LIVESTOCK FEED SUPPLIES

Introduction

When supplies of legume and grass forages normally used in ruminant feeding are reduced, livestock producers must seek other roughage sources. A wide range of possibilities exist in Manitoba.

Extending Livestock Feed Supplies was originally produced as a reference on alternative feeds for producers facing feed shortages during the 1980 Manitoba drought.

Average feeding values, energy levels (designated as TDN) and recommended feeding rates for the alternative feeds available in Manitoba are given in this publication. Their use need not be limited to drought conditions.

Alfalfa Cubes

Alfalfa is usually coarsely chopped and artificially dried before being formed into cubes about 3.2 cm (1.25 inches) on a side with varying lengths. The major difference between alfalfa cubes and pellets is the size of the forage particles. Alfalfa cubes contain much coarser material and may be used as the only source of forage in dairy cattle rations.

Feeding: If cubes are the only source of roughage, adapt dairy cows over a period of one to two weeks by initially feeding limited amounts. Not all cows in the herd will consume adequate amounts of cubes as the only roughage. In feeding trials at the University of Saskatchewan a few individual cows would consume only 4.5 to 5.5 kg (10 to 12 lbs) of cubes daily, though most would consume 9 to 14 kg (20 to 30 lbs). To minimize unsatisfactory performance by individual cows feed at least 2.5 kg (5 lbs) of long hay with alfalfa cubes.

Alfalfa Pellets

Dehydrated alfalfa: Dehydrated alfalfa pellets consist of alfalfa forage harvested at the late bud or early bloom stage. It is artificially dried soon after harvesting, then ground and pelleted to produce a 1.3 cm (0.5 inches) diameter pellet. These dehydrated pellets contain 16 to 20 per cent crude protein, 1.5 to 2.0 per cent calcium and 0.2 to 0.3 per cent phosphorus. The TDN content (energy level) when fed in a mixed hay-grain ration to dairy cattle is about 60 per cent.

Feeding: Consuming too high a level of dehydrated pellets causes digestive upsets and cows will go off feed. The recommended maximum feeding level of dehydrated alfalfa pellets for dairy cows is 4 kg (8 lb)/cow daily. Feed at least 4.5 kg (10 lb) of fair quality hay or straw with dehydrated alfalfa pellets unless there is an extreme forage shortage.

Sun Cured Pellets: Sun cured alfalfa pellets are produced in a similar way to dehydrated pellets except the forage is field dried. Forage used represents a greater range in maturity of forage. For these reasons the nutrient content of sun cured alfalfa pellets is generally lower than the dehydrated pellets. Protein content normally ranges from 13 to 15 per cent, calcium 1 to 1.5 per cent, phosphorus 0.2 to 0.3 per cent and TDN between 50 and 60 per cent. Sun cured pellets can be fed at up to 3 to 4 kg (6 to 8 lb) per milking cow daily, and like dehydrated pellets may be used to supplement low quality forage.

Barley

Forage: Barley can be used for hay, silage or pasture, but may contain high levels of nitrates (see section on nitrate poisoning). Awns may be a problem when feeding the mature plant unless the mature crop is ensiled.

Grain: Barley is the most common small grain fed to livestock. It is intermediate in protein and energy, between oats and wheat.

Dry Matter Nutrient Content	%
Dry Matter	100
Crude Protein	12
Crude Fiber	6
TDN	83
Calcium	0.05
Phosphorus	0.37

Beet Tops

Beet tops contain about 18 per cent dry matter. At this moisture level, the leaves supply on average, 7/10 of a tonne (2/3 of a ton) of tops for every tonne of beets. In other words, an 18 tonne (20 ton) crop of beets will supply about 13 tonne (14 tons) of tops per 0.4 ha (1 acre).

Dry Matter Nutrient Content	%
Dry Matter	100
Crude Protein	12
Crude Fiber	13
TDN	55
Calcium	1.0
Phosphorus	0.22

Feeding: In Colorado, field-cured beet tops have about 72 per cent of the value of alfalfa hay. Ensiling is a good way of handling beet tops. They are a highly laxative feed and should be fed with other roughage or grain. Beet tops are not recommended as t ıe only roughage source. When included in a balanced ration, beet tops are satisfactory for beef and dairy cattle or lambs. Since beet tops are high in oxalic acid, extra calcium must be fed. Feed 50 g (2 ounces) of limestone with each 45 kg (100 lb) of tops.

Literature from Idaho suggests cutting beet tops no sooner than a week before the beet root harvest. The sugar content of the root declines an average of 0.8 per cent per week after top cutting. Sugar loss is lower late in the season.

Sugar beet tops which have been sprayed may present a feeding problem. Check with your agricultural representative before using as feed.

Dried Beet Pulp/Dried Molasses Beet Pulp: Beet pulp is normally dried at the factory or is combined with molasses and dried to form dried molasses beet pulp. These feeds are palatable, bulky and slightly laxative.

Dry Matter Nutrient Content	Dried Beet Pulp %	Dried Molasses Beet Pulp %
Dry Matter	100	100
Crude Protein	9.5	9.6
Crude Fiber	21	17
TDN	72	75
Calcium	0.70	0.63
Phosphorus	0.10	0.09

Because of its bulky nature and excellent palatability, most beet pulp is used for feeding dairy cows.

Brewers Grains

During the brewing process, barley, malt and other cereals (usually corn) are mixed with warm water. Much of the carbohydrate is converted to sugar with the resulting liquid being used in the brewing process. The residue which contains proteins, fats and unextracted carbohydrate is known as Brewer's Grains. They are available in two forms, either drained and sold as wet brewers grains or put through a dryer and sold as dry grains.

Dry Matter Nutrient Content (Wet brewers grain)	As Fed Basis %	Dry Matter Basis %
Dry Matter	22-25	100
Crude Protein	5-6	24
TDN	16	70
Crude Fat	1.6	7.0
Crude Fiber	3.6	16.0
Calcium	0.07	0.35
Phosphorus	0.14	0.60

Feeding: Wet grains can replace silage in diets on a pound for pound basis, while 2 kg (4 lb) of wet brewers grain are considered equivalent to 0.5 kg (1 lb) of dairy concentrate. Brewers grains have been used widely in dairy rations, but can be used effectively in beef cattle, sheep, horse and swine rations.

Dairy Cattle: Wet brewers grains may be fed at a rate of 9 to 14 kg (20 to 30 lb) per head per day to replace an equal weight of silage. As a substitute for part of the concentrate mix, feed at a rate of 1.8 to 2.0 kg (4 to 4.5 lb) of wet grain for each 0.5 kg (1 lb) of the concentrate mixture. This replaces a maximum of 3 to 4 kg (6 to 8 lb) of dry grain mix.

Beef Cattle and Sheep: Wet brewers grains can be used as a partial substitute for both the roughage and grain portion in beef cattle and sheep rations.

Horses: Brewers grains can be substituted for up to one-third of the oats in horse feed with 1.8 to 2 kg (4 to 4.5 lb) of wet grain being about equal to 0.5 kg (1 lb) of oats. Generally, horses are more susceptible to digestive disturbances and should be watched.

Swine: Because of their bulkiness, brewers grains are not generally used in large amounts for swine rations. They can be fed wet to growing-finishing hogs at levels up to 10 to 15 per cent of the ration on a dry matter basis. Wet grains can also be fed to sows and gilts at levels of 20 to 30 per cent of the grain ration.

Animal	Wet Brewers Grains/Day kg (lbs)	Dry Feed Replaced kg (lbs)
Dairy Cattle	11.5-16 (25-35)	3-4 (6-8)
Beef Cattle	9-14 (20-30)	2.5-3.5 (5-7)
Sheep	2-4 (4-8)	.5-1 (1-2)
Horses	9-11 (20-25)	2.5-3.5 (5-7)
Swine (breeding)	3-4.5 (6-10)	.7-1 (1.5-2.5)
Swine (finishing)	1.5-2.5 (3-5)	.3-.5 (0.7-1.2)

As with other grain feeding, introduce brewers grains slowly to prevent overeating or rumen overload problems. Do not leave uneaten feed in the feeders as souring and spoilage will occur, and do not feed mouldy feeds. Storage may be a problem due to high moisture content. Wet brewers grains should be stored off the ground on a cement pad or on as small a floor area as possible. The wet grains may be kept up to 8 to 10 days in hot weather without excessive spoilage.

Buckwheat

Forage: Buckwheat straw is low in feeding value, containing on a dry matter basis about 4 per cent crude protein, 40 per cent crude fiber, and a TDN for beef cattle of about 40 per cent. Buckwheat straw, green fodder and grain may cause peculiar eruptions and intense itching of white and light colored portions of the skin.

Dry Matter Nutrient Content (Seed)	%
Dry Matter	100
Crude Protein	14
Crude Fiber	14
TDN	65
Calcium	0.10
Phosphorus	0.35

In cattle feeds, buckwheat is worth about 10 per cent less than oats. It is not as palatable as most other grains and should form no more than 20 to 25 per cent of any concentrate mixture for dairy or beef cows.

Cereal Crop Hays or Silage

For maximum feeding value, cereal crops to be used for forage should be cut in the early dough stage (roughly when the crop starts turning color, but is still predominately green). If left to turn color the hay will be strawlike and lower in palatability.

Dry Matter Nutrient Content	%
Dry Matter	100
Crude Protein	12
TDN	60-65

Oat and barley forage cut at the proper stage compare well to good hay. Wheat and rye hays have about 90 per cent of this feeding value. Nitrate poisoning may be a problem with cereal forages (see section on nitrate poisoning). Of the cereal hays, oats are most likely to contain toxic levels of nitrates. However, other grains and even alfalfa are not certain to be free from high levels of nitrates.

Corn

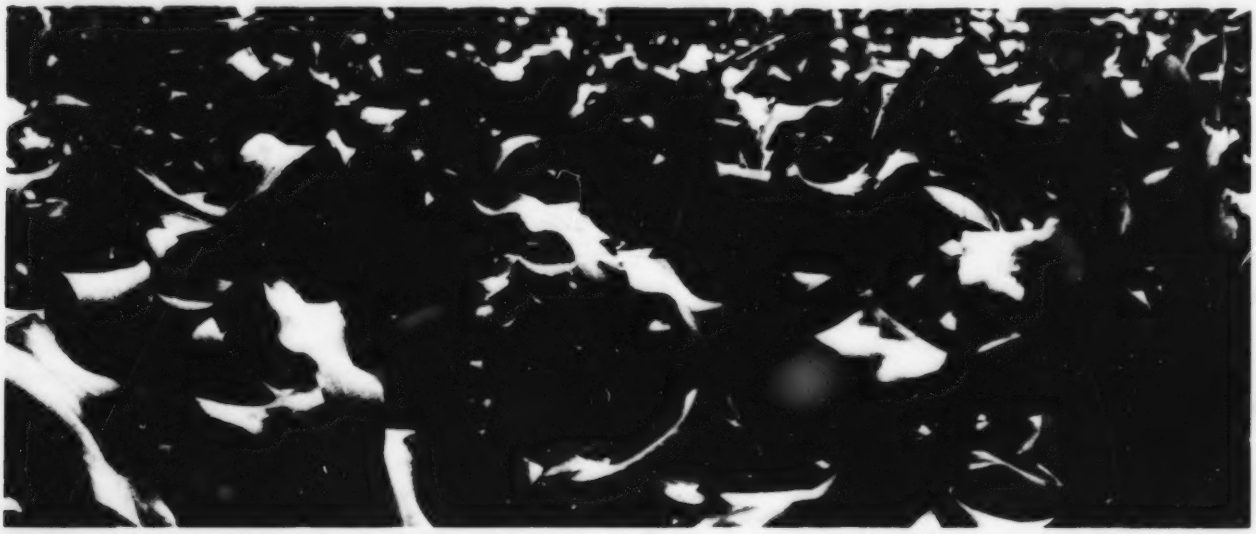
Corn Silage: Corn silage is a very palatable high energy roughage. Actual energy content depends largely on the amount of grain present.

Dry Matter Nutrient Content (Corn Silage)	Well-eared Well Matured %	Few ears Well Matured %	No ears Stover %	Corn Stalks %
Dry Matter	100	100	100	100
Crude Protein	8-9	8-9	7	4
Crude Fiber	20-25	25-30	30-35	35-40
TDN	70	61	55-58	45-50
Calcium	0.27	0.35	0.38	0.30
Phosphorus	0.20	0.20	0.19	0.10

Feeding: Corn silage can be fed to dairy cows as their major source of roughage, provided 2.5 to 3.5 kg (5 to 7 lb) of long hay is fed per cow daily. The long hay is required to prevent depression of milk fat. Dry cows will get too fat on a diet of straight corn silage and so should be limited. As an alternative, feed a lower quality roughage. This also applies to beef cattle in the early stages of gestation. Corn silage makes an excellent feed for the last month of pregnancy and during lactation. Do not feed corn silage as the sole source of roughage to young animals; they do not have the capacity to eat enough to satisfy their nutrient requirements.

Corn Stover: Corn stover is the plant material left after harvesting corn for grain. It contains leaves as well as stalks and can be a good source of feed for animals during gestation. It can supply most of a dry, pregnant cow's energy requirements until a month before calving.

Corn stalkage consists of stalks with few or no leaves and is roughly equivalent to other cereal straws.



Corn forage is low in protein, minerals and may be low in vitamins. All corn forages must be properly supplemented with these to produce satisfactory results.

Grain: In the United States, corn is the most widely available and widely used source of energy for all classes of livestock.

Dry Matter Nutrient Content	%
Dry Matter	100
Crude Protein	10
Crude Fiber	2
TDN	90
Calcium	0.03
Phosphorus	0.31

Generally, corn is worth from 110 to 115 per cent the value of barley. However, it usually requires 50 to 100 per cent more protein supplement for all classes of livestock and poultry when used as the sole grain. This is because it is particularly low in protein compared to the other grains. Corn is also lower in calcium and phosphorus compared to our cereal grains.

For ground corn a medium to coarse grind is preferred. This can be accomplished using 0.9 to 1.3 cm (3/8 to 1/2 inch) hammermill screen. Rolled corn is commonly called cracked corn.

Distillers Dried Grains

Residue remaining after alcohol has been distilled from grain processed for alcohol production is called distillers dried grain. Before being sold it is normally dried down to 90 per cent dry matter. As with brewers grains, distillers dried grains are fed mainly to dairy cattle as a protein and energy source. Content of some nutrients may vary depending on the grain used.

Dry Matter Nutrient Content	Distillers Grain with Soluables %
Dry Matter	100
Crude Protein	28-31
TDN	80
Crude Fiber	10-12
Fat	9-11
Calcium	0.10
Phosphorus	0.80

Fababeans

Forage: Fababeans make good silage and contain about the same energy and protein concentration as alfalfa. Although very dark in color, the silage is palatable.

Dry Matter Nutrient Content	%
Dry Matter	100
Crude Protein	17
Crude Fiber	30
TDN	60-65

Seed: Fababeans are palatable, digestible and non-toxic. The raw unprocessed bean produced on the farm can be ground or hammermilled using a 1.3 cm (1/2 inch) screen and mixed directly into rations for all classes of livestock.

Feeding: When substituting fababeans for soybean meal, 1 kg (2 lbs) of fababeans replaces 0.5 kg (1 lb) of soybean meal and 0.5 kg (1 lb) grain in the ration. This 2:1 relationship exists because the protein content of the fababean is about half that of soybean meal.

Dry Matter Nutrient Content	%
Dry Matter	100
Crude Protein	26
Crude Fiber	9
TDN	82
Calcium	0.15
Phosphorus	0.55

Feeding trials at the University of Manitoba have indicated that fababeans can make up to 35 per cent of the dairy concentrate without adversely affecting the production of milk.

Fababean meal may replace other vegetable protein supplements in both calf starter and grower rations. For beef cattle and sheep, fababeans can be used to supply the supllemental protein for all classes of stock. For further information, see Agriculture Canada Publication 1540, *Growing and Using Fababeans.*

Flax

Forage: Immature flax or flax straw may contain high levels of prussic acid (see section on prussic acid) and should be tested before feeding. Flax straw is very low in feeding value.

Dry Matter Nutrient Content (Flax Straw)	%
Dry Matter	100
Crude Protein	4
Crude Fiber	50-55
TDN	35-40

Dry Matter Nutrient Content (Whole Flaxseed)	%
Dry Matter	100
Crude Protein	25
Crude Fiber	7
TDN	118
Fat	38
Calcium	0.23
Phosphorus	0.55

Feeding: Limit whole flaxseed to a maximum of 10 per cent of the grain ration for beef and dairy cows. It can be used in about the same proportion of the grain ration for sheep and horses, but combine it with other protein supplements when fed to swine.

Grain Screenings

When cereals and other small grains are threshed, they contain various amounts of materials called screenings. These are removed before the grain is used for human consumption, exported or put to other uses where grains of a specific quality are required. The screenings consist of small, broken or shrunken kernels of grain. They may also contain wild oats and wild buckwheat, other weed seeds, chaff and broken pieces of stem.

The main concern when using screenings for feed is the variability of composition. As screenings represent a source of feed energy, their composition determines their usefulness as a feed. The best grades of screenings, consisting chiefly of broken and shrunken kernels of small grain, contain just slightly less feeding value than oats.

Screenings from the cleaning of canola and flax crops may be even higher in feeding value. As canola and flaxseed contain high levels of oils, which are high in energy, the screenings may be similar to barley in energy content and higher in protein. However, the high oil levels impose an upper limit on the level that these screenings can be incorporated into a diet without causing digestive upsets.

Light, chaffy screenings with an abundance of small weed seeds are much lower in feeding value, and are extremely variable in composition.

Dry Matter Nutrient Content (Average grain screenings)	%
Dry Matter	100
Crude Protein	12
Crude Fiber	21-25
TDN	65-70

Note: *There is considerable variation in screenings composition, depending on the source. Each batch should be analyzed for nutrient content.*

Feeding: Grain screenings can be used to extend feed supplies for ruminant animals which are not at high levels of production. They can be put to good use as the only concentrate fed to dry cows and replacement heifers provided the forage is of reasonable quality. If the forage is not of good quality, feed up to 3 kg (6 lb) per head each day for heifers weighing 227 to 318 kg (500 to 700 lb) or 4.5 kg (10 lb) per head each day for dry cows and beef cows. Supply extra energy when required using cereal grains.

For dairy cattle, limited amounts of screenings may be used as a partial substitute for both roughage and grain. For 1 kg (2.2 lb) of pelleted screenings fed, both the amount of grain and the amount of forage should be reduced 0.5 kg (1 lb) each. Total screenings fed to milking cows should not exceed 3 to 4 kg (6 to 8 lb) per day.

As with any new feed, gradually increase the amount fed to this maximum level over a one week period. It is possible that feeding some batches of screenings could have a detectable effect on milk flavor. This should not be a significant problem if the screenings are not fed within two hours before milking. This is the same precaution that should be taken when feeding silage.

Low grade screenings are not recommended for swine. If used, incorporate them at low levels into finishing rations.

Liquid Supplements

Liquid supplements consist of a liquid medium plus one or more additives, i.e. molasses containing urea, minerals and vitamins. They have a place in cattle rations, but the feeding program should be carefully evaluated to assure efficient use.

Liquid supplements are a protein supplement — not a complete ration. They are usually based on molasses diluted with water, giving about 70 per cent dry matter. Propylene glycol is used as a preservative and depresses the freezing point. They contain about the same total energy content as average grain screenings on a dry matter basis.

The protein source is primarily urea although molasses contains 9 to 10 per cent protein. Most liquid supplements are in the range of 30 to 35 per cent crude protein, 25 to 28 per cent of which comes from urea. In other words, about 80 per cent of the crude protein is from urea.

About 0.5 to 2.0 per cent phosphorus is normally added. Little calcium is added as it will not stay suspended in the liquid mix. Therefore, a mineral mix containing calcium should also be fed. Other trace minerals may be added and liquid supplements may be fortified with vitamins.

Late summer pastures and poor quality winter roughages sometimes lack protein. A liquid supplement may help to improve low quality pasture or dry forage. However, when the amount and energy content of forage is not sufficient, cattle require a complete ration rather than only a protein supplement. If the supplemental energy contains grain, it may be more economical to use a dry protein supplement mixed with the grain.

Advantages of Liquid Supplement

- When sprayed on poor quality roughages, palatability and intake are improved. Also, there is some evidence that digestion may be improved.
- Easy to use and convenient as it is commonly used free-choice with consumption being limited by the use of a lick wheel.
- Provides not only protein, but other ration ingredients including some minerals and vitamins.

Disadvantages of Liquid Supplement

- Not a major source of energy as only a very limited amount can be fed, normally 0.5 to 1 kg (1 to 2 lb) per day.
- Cattle eat varying amounts.
- Unless sufficient energy is available in the ration, supplemental protein may not be used very efficiently.
- If sufficient energy is not otherwise available, cattle may overeat liquid supplement with toxic effects.
- Non-protein nitrogen may not be utilized as efficiently in cattle under 272 kg (600 lb).

Millet

Forage: Millet can be used for hay, pasture or silage. Feeding value is greatest for the total crop during the period from flowering to milk stage.

Dry Matter Nutrient Content	Hay %	Straw %
Dry Matter	100	100
Crude Protein	8-9	4
Crude Fiber	30	42
TDN	57	47
Calcium	0.33	0.09
Phosphorus	0.20	0.20

Millet grain is an acceptable feed provided it is ground.

Dry Matter Nutrient Content (Grain)	%
Dry Matter	100
Crude Protein	13
Crude Fiber	9
TDN	85
Calcium	0.06
Phosphorus	0.22

Molasses

Molasses is a by-product of the sugar industry. It is a readily available energy source, high in sugar and very palatable. Beet molasses is about 77 per cent dry matter.

Dry Matter Nutrient Content	%
Dry Matter	100
Crude Protein	9-10
Crude Fiber	0
TDN	75
Calcium	0.21
Phosphorus	0.40

Feeding: Since beet molasses is much more laxative than cane molasses, the amounts fed should be limited. In ruminant rations, use only 5 to 10 per cent for maximum efficiency.

Besides being an energy feed, molasses:

- is an appetizer
- reduces ration dustiness
- improves the palatability of low quality roughages
- provides a carrier for non-protein nitrogen and vitamins in liquid supplements.

Native Hays

Native hays vary widely in nutritional value. Upland hays, cut at the proper stage, are comparable to tame grass hays. When harvested at an advanced stage of maturity, they will have a lower feeding value. Marsh or slough hays are usually inferior in feeding value to upland hays. They are coarse and fibrous in composition and about equal in feeding value to average quality straw.

Oats

Forage: Oats make excellent pasture and good hay or silage when properly handled. Oat forages in particular are likely to contain high levels of nitrates (see section on nitrate poisoning).

Dry Matter Nutrient Content (Grain)	%
Dry Matter	100
Crude Protein	10-11
Crude Fiber	12
TDN	76
Calcium	0.07
Phosphorus	0.40

Oats contain less energy than wheat or barley. As a result, they are usually combined with a higher energy feed to achieve maximum production from dairy cows and growing-finishing animals.

Peas

Forage: Peas are commonly seeded with oats for hay, silage or grazing. Do not feed pea vines to sheep. For straw see legume straw.

Dry Matter Nutrient Content (Grain)	%
Dry Matter	100
Crude Protein	25
Crude Fiber	7
TDN	85
Calcium	0.19
Phosphorus	0.50

Note: *Peas can be fed as the only protein supplement to dairy and beef cattle, sheep, horses, mature pigs and growing-finishing swine.*

Potatoes

The following table compares the average analyses of potatoes to barley. All values except dry matter are reported on a dry matter basis.

Dry Matter Nutrient Content	Potatoes %	Barley %
Dry Matter	25.0	88.0
Crude Protein	9.5	12.0
Crude Fiber	2.1	5.6
Calcium	.04	.09
Phosphorus	.23	.47
TDN	80.0	83.0

Potatoes are worth 22 to 25 per cent of the feeding value of grain. That is, about 182 to 205 kg (400 to 450 lb) of potatoes have the same total energy as 45 kg (100 lb) of grain.

Feeding: In limited amounts and in properly balanced rations, potatoes are a satisfactory energy feed for beef cattle, dairy cows, sheep and horses. Cook potatoes if they are being fed to swine.

Often potatoes are not very palatable so they should be introduced gradually. Feeding them in too large an amount may cause scours. Also, remove long sprouts before feeding since they may contain solanin, an alkaloid, which is toxic. When feeding whole potatoes there may be some difficulty with choking. Alternatively, they can be fed chopped, but this increases the cost.

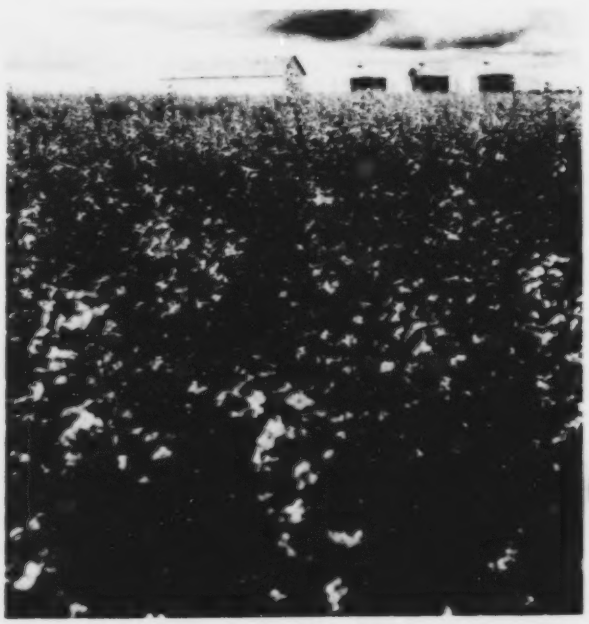
Potatoes may be ensiled. Potato silage is eaten readily by animals and is about equal to corn silage in value per ton. For further information see Agriculture Canada Publication #1527 *Guidelines for Feeding Potato Wastes.*

Canola Rapeseed

Either traditional rapeseed varieties or the new canola varieties of rapeseed are useful as pasture. Only canola is recommended for feeding as seed or meal as outlined below.

Forage: Although the use of canola meal is reasonably well documented, little information is available on the use of whole plant rapeseed. Generally, it can be used as a pasture crop for swine, sheep and cattle. Dairy cows should be given access to rapeseed immediately after milking only, to avoid tainting milk. Rapeseed forage may cause bloat, so the same precautions should be taken as with alfalfa. Animals on rapeseed require plenty of salt. (These are general recommendations based on traditional varieties).

Although there is no reason to suspect that new varieties will cause any particular problems, care should be taken in introducing animals to this feed. Rapeseed pasture contains about the same protein and energy value as alfalfa on a dry matter basis.



Dry Matter Nutrient Content	Pasture Basis %	Dry Matter Basis %
Dry Matter	15-20	100
Crude Protein	3	17
Crude Fiber	3	15
TDN	12	65
Calcium	0.25	1.5
Phosphorus	0.07	0.40

Information at this time indicates that rapeseed should not be used as a silage crop. Frozen rape was baled and fed in the Roblin area during the fall and winter of 1979-80 with apparent good results.

Rapeseed straw is extremely low in feeding value. It contains on a dry matter basis 3 to 4 per cent crude protein, 50 to 60 per cent crude fiber and a TDN of about 20 per cent.

Dry Matter Nutrient Content (Seed)	%
Dry Matter	100
Crude Protein	25
Crude Fiber	7
TDN	125
Fat	48
Calcium	0.31
Phosphorus	0.61

The high fat level in full fat canola or rapeseed limits its use in rations and may present handling problems when grinding, etc. In general, introduce full fat rapeseed or canola gradually and do not use at more than 10 per cent of the grain ration for dairy and beef cows. Depending on variety, there may also be other problems if these feeding levels are exceeded.

Canola Meal

Canola meal is a low erucic acid, low glucosinolate rapeseed meal, and contains an average of 37 per cent crude protein. It can be used to replace part or all soybean meal in dairy rations. At up to the maximum suggested level of 25 per cent of the grain mix for dairy cows, canola meal produces results equivalent to soybean meal. For all classes of livestock, canola meal will produce results equivalent to soybean meal when properly used. It should be compared to soybean meal for ruminant rations on the basis of cost per unit of protein.

Reed Canary Grass

This crop can be pastured or used for hay. On a dry matter basis, the hay contains 15 to 17 per cent crude protein and 55-60 per cent TDN. Old varieties were high in alkaloids, which over time can cause animals to decrease consumption. However, low alkaloid varieties are now on the market, including Rival, Venture, Vantage and Paladon.

Rye

Forage: Rye, as a hay crop, is coarse and lacks palatability. It can be pastured, but like other cereals may contain high levels of nitrates (see section on nitrate poisoning). Ergot in rye forage is not a problem if it is cut at the milk or early dough stage or before ergot bodies form.

Rye straw is coarse, unpalatable and low in feed value having a TDN of 40 per cent on a dry matter basis.

Dry Matter Nutrient Content (Seed)	%
Dry Matter	100
Crude Protein	12
Crude Fiber	3
TDN	80
Calcium	0.07
Phosphorus	0.36

Feeding: University of Manitoba work on feeding rye showed that rye can replace barley in diets for growing and finishing beef cattle. Ensure that ergot levels are minimal when feeding rye to all classes of cattle and particularly gestating and lactating cows (see section on ergot). Rye is also effective as a replacement for 25 to 50 per cent of barley in the grain mix for dairy cows with no effect on intake or milk production. There may be a reduction in intake when rye is fed to very young dairy calves or when fed to growing-finishing sheep at levels above 50 per cent of the ration.

Sorghums and Sudan Grass

Sorghum varieties and hybrids are classified according to use as follows:

- Grain sorghum
- Forage sorghum
- Syrup sorghum
- Sudan grass
- Broom corn

Grain and forage sorghum as well as sudan grass can be used for hay or silage. It is recommended that the crop be put up as silage. A high moisture content of 80 per cent is retained until the first killing frost, and the thick juicy stems are difficult to cure even when crushed. Chances of producing a high quality hay are poor.

Quality forage sorghum silage is a useful feed for dairy and beef cattle, but is generally lower in feeding value than well cured, well matured corn silage. The chief interest in growing sorghum for silage is that it can produce a given unit of dry matter with a low water requirement.

The ideal time to harvest sudan grass, sorghum — sudan grass hybrids, and forage sorghums for forage is when the seed is in the late dough stage. This is the best time for a combination of high yield and high nutritional quality. The effect of growth stage on feeding value is similar to that for other forage grasses.

Although relatively little work has been done in Manitoba on sorghums, indications are that in the vegetative stage with no head they contain 15 to 20 per cent dry matter, 16 to 20 per cent crude protein, 30 to 32 per cent crude fiber and a TDN of 50 to 55 per cent. Silage from mature well-headed out plants will contain on a dry matter basis, 9 to 10 per cent protein, 30 to 35 per cent crude fiber and 55 to 60 per cent TDN.

Sorghum-sudans are not generally recommended for pasture. Cattle and sheep may develop prussic acid poisoning from eating sorghums grown and fed under certain conditions (see section on prussic acid poisoning). The content of this toxic material is always highest in the young immature parts of the plant. New shoots of sudan grass may be dangerous until they reach 45 to 50 cm (18 to 20 inches). Sorghum - sudan grass hybrids are usually higher in prussic acid than sudan grass and are dangerous until they are at least 75 to 100 cm (30 to 40 inches). Adverse conditions such as drought, cool weather or frost retard growth and extend the critical period. Prussic acid content is high in crops grown on soils with high soil nitrates.

Plant tissue killed by freezing may contain higher amounts of prussic acid directly after freezing. Frost that kills the top-growth may not kill the base of the plant and new shoots are high in prussic acid. Cattle grazing tend to avoid the tall frosted growth and graze on the young shoots. *Never* turn cattle into a field after the crop has been taken off. For grazing with minimum risk, wait until the crop reaches the height previously suggested. Turn cattle into a small section of the field, graze it down rapidly, then remove the animals until the crop again reaches a safe height.

Sudan and hybrid sudans in the growing stage should never be grazed by horses, because of the hazard of cystitis. This disease, which occurs more frequently in mares than in stallions or geldings, is characterized by continuous urination, mares appearing to be constantly in heat, and incoordination in the gait. Animals seldom recover after either the incoordination or the dribbling of urine becomes evident. Apparently, hay from sudan and hybrid sudans will not produce the same malady.

Nitrates may also be a problem (see section on nitrate poisoning). If retarded growth is observed, test the forage before feeding it. Do not feed ensiled material for two to three weeks after ensiling. This allows some of the nitrates to be lost to the air. Silage may contain harmful amounts of prussic acid, but usually, as with nitrates, the ensiling process decreases the levels of prussic acid to non-toxic levels.

Straws

Ammoniated Straw: Ammoniation of straw has been used to improve its nutritional value as a feed for ruminants. The procedure involves covering a straw stack with plastic and injecting anhydrous ammonia into the sealed stack. Along with additional nitrogen (from two to three per cent to seven to ten per cent depending on quantity of ammonia added), there is an increase in consumption and total digestible nutrients. The length of time the stack should be covered is related to the environmental temperature. Take care when handling anhydrous ammonia and allow several days once the stack is uncovered before feeding. There are potential hazards to both humans and livestock when handling ammonia. See Manitoba Agriculture Factsheet "Ammoniation of Forages." Straw quality and moisture content of the straw are important considerations. Consult your agriculture representative or livestock specialist before ammoniating straws.

Cereal Straws: Straws are low in protein, vitamins and minerals. In livestock rations they are used primarily to supply bulk and some energy. The order of desirability for cereal straws is oats, barley then wheat straw. Oat and barley straws usually have a TDN on a dry matter basis between 45 and 48 per cent or about 60 per cent of the energy value of a brome-alfalfa hay mixture. Wheat and rye straws contain only 25 per cent of the energy of good quality hays. Straws are poorly digested and may cause a digestive upset (compaction in the rumen) if they are the only feed source. For more information on feeding straws from various crops, check under the specific crop.

Grass Seed Type Straws: Straws from grass seed producing plants such as millet, timothy and meadow fescue have an energy and protein level similar to cereal straws.

Legume Straw: The feeding value depends on the proportion of leaves. Legume straws may contain slightly more protein than cereal straws, yet have a similar fibre level and energy content. Use legume straw only as a part of the roughage ration.

Sunflowers

Sunflower silage is used effectively by livestock. Ensiling is done when 50 to 65 per cent of the plants are in bloom. Later harvesting results in a less palatable feed. Early studies indicate that sunflower silage has two-thirds of the total digestible nutrients of corn silage.

The best sunflower silage is produced when the whole plant is harvested. Length of cut is similar to corn silage, ideally 2 to 4 cm (0.75 to 1.5 inches). Recent studies in Minnesota have shown the moisture content should be in the range of 65 to 70 per cent. The material in the Minnesota tests was stored in a glass-lined silo.

Sunflower Meal: Protein and energy level of sunflower meal can vary a great deal depending on the amount of hull remaining in the meal. Meal from CSP Foods, Altona, has a relatively low level of hull (14 per cent fibre) and a protein level of 40 per cent. Sunflower meal from some oil extraction plants may contain 25 per cent fibre and 25 to 30 per cent protein.

Research, although limited, indicates that sunflower meal can be used to replace soybean meal in dairy and beef rations. It will produce results equal to soybean meal for ruminant rations when properly supplemented. It should be compared with soybean meal for ruminant rations on the basis of cost per unit of protein.

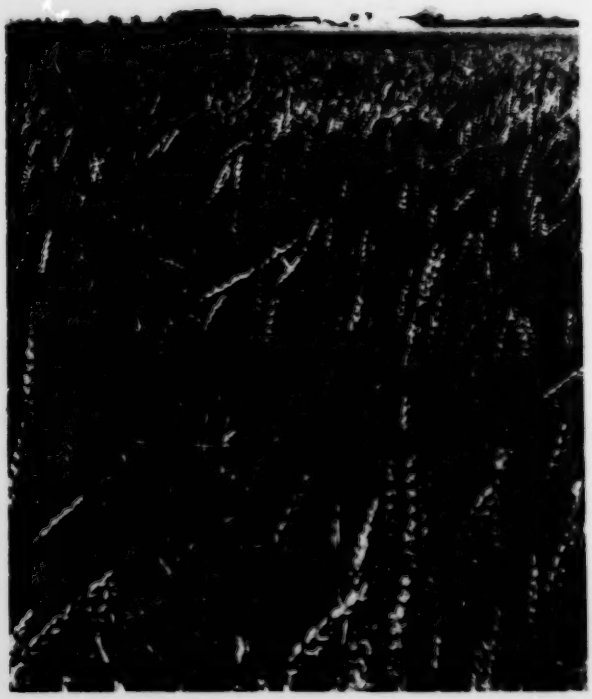
Wheat

Forage: Wheat can be used for hay, silage or pasture but may contain high levels of nitrates (see section on nitrate poisoning). Wheat pasture is known to cause bloat, so animals should be watched closely.

Wheat grain is a high energy feed which may be used for livestock provided certain limitations are recognized.

Dry Matter Nutrient Content (Grain)	%
Dry Matter	100
Crude Protein	13
Crude Fiber	2.7
TDN	88
Calcium	0.05
Phosphorus	0.45

Feeding: Wheat tends to become gummy when finely ground, so it should be rolled or coarsely ground. Rations containing too high a level of wheat tend to cause digestive upsets when fed to ruminant animals. For dairy cows and feedlot animals, limit wheat in the ration to a maximum of 30 to 40 per cent of the grain mix. Wheat can be fed as the only grain to dry cows, beef cows and heifers as long as roughages are provided free choice and not more than 4 to 4.5 kg (8 to 10 lb) of wheat per cow daily and 2.5 kg (5 lb) of wheat per heifer daily is fed.



Severe Restriction of Roughage

Producers may need to severely restrict the amount of roughage fed daily. What is critical is the minimum amount that can be fed to the various classes of livestock which will maintain the rumination (cud chewing) necessary to avoid digestive disturbances. All roughages, regardless of nutritional worth, can be used to maintain and stimulate this vital process. **This table shows the minimum daily roughages considered necessary to keep the digestive system working properly.**

Livestock Type	Air Dry kg/day	Air Dry lbs/day
Dairy Cows - Milking	5.5-7.0	12-15
Beef Cows - Dry Dairy Cows	2-2.5	4-6
Yearling Cattle and Calves	1.5	3-5
Feedlot Cattle	1.5	3
Sheep (All Ages)	.2	0.5

Dairy Cattle

Producing dairy cows require a minimum of 5.5 to 7 kg (12 to 15 lb) per day of roughage. When cows are fed these minimum amounts, it is necessary to feed large quantities of grain to maintain satisfactory milk production. The low roughage level may also lead to a depression in milk fat and every effort should be made to avoid this. The loss in revenue to producers shipping milk testing at 2.6 kg butterfat/HL as opposed to testing at 3.6 kg butterfat/HL is $6.02 per hectolitre (as of July, 1988).

Feeding grain more frequently during the day has less fat depressing effect. Coarse grinding grain has less fat depressing effect than fine grinding and pelleting. Ground straw can be incorporated into the ration to raise the fibre to acceptable levels.

High producing cows will eat up to 18 to 20 kg (40 to 45 lb) per day of grain before they back off feed. Good quality hay should be fed to high producing cows and straw kept at a minimum. Cows producing less than 23 kg (50 lb) of milk can be fed up to 4 kg (8 lb) of straw ground in the concentrate as well as 2 to 2.5 kg (4 to 5 lb) of long hay if properly supplemented. If straw is not ground, feed 4 kg (8 lb) of good alfalfa hay and straw free choice.

Barley should be the basis for dairy concentrate mixtures, but oats and wheat may be substituted for barley at up to the 40 per cent level. Use a commercial vitamin-mineral mix and follow label directions. Analyze the forage before mixing to determine the most efficient level of protein to be incorporated into the concentrate.

Work at the University of Manitoba has been done on using coarsely ground straw to replace part of or stretch the good quality forage in rations for dairy cows. The following examples would need about 25 per cent less good quality roughage:

Cows in early lactation: Add 136 kg (300 lb) of ground straw per ton of grain mix. Feed 1.5 to 2 kg (3 to 4 lb) more of the grain-straw mixture per cow per day compared to levels normally fed. Reduce the amount of hay normally fed by about 2.5 kg (5 lb) per day. This means the cow would now be getting about 7 kg (15 lb) of good quality hay per day.

Cows in the latter stages of lactation: The level of ground straw could be increased to 227 kg (500 lb) per ton of mix. The amount of grain-straw mixture fed should be increased by 25 per cent over the normal level of feeding. Hay should be decreased by 2.5 to 3 kg (5 to 7 lb) from normal when feeding 7.5 kg (16 lb) of the grain-straw mix.

Note: *Protein, minerals and vitamins may have to be adjusted to allow for straw in the concentrate.*

Dry Cows, Heifers and Beef Cows

The problem of wintering and feeding dry cows, beef cows and bred heifers under conditions of limited roughage can be solved by using grains to replace a large proportion of the roughage.

Breeding Stock: Herds can be maintained on as little as 2 to 2.5 kg (4 to 6 lb) of roughage per animal per day provided sufficient grain is available. The amount of grain necessary for each cow will depend on the initial condition of the animal and the quality of the roughage. From 3 to 4.5 kg (6 to 10 lb) of grain is suggested, with poorer conditioned animals receiving the higher amount.

Dry dairy cows fed limited roughage: Increase the grain allowance to 4.5 kg (10 lb) daily one month before calving.

Beef cows: Increase the grain allowance during the last two months before calving and maintain it after calving to ensure a thrifty calf, satisfactory milk supply and good rebreeding performance.

Yearling and older heifers: These can be wintered on 2.5 kg (5 lb) per day of good roughage and an equal or greater quantity of a grain mixture.

If poor quality roughage such as straw is used, include a protein supplement in the ration during the last two months of pregnancy and until the cows are on satisfactory pasture. Vitamins A, D and E must be supplemented, especially when feeding low or poor quality roughage rations. Minerals must be properly supplemented.

Lactating beef cows: Feed 6 to 7 kg (14 to 16 lb) of straw per day plus 4.5 to 7 kg (10 to 15 lb) of grain if properly supplemented.

Calves

Good quality roughage, if very limited in supply should be reserved for young calves up to eight months. While calves can be restricted as to amount of intake, what is consumed must be of good quality because calves have a restricted capacity to digest coarse, fibrous feeds.

After weaning, calves can be wintered on straw or poor quality roughage if it is ground, along with 50 to 60 per cent grain in the diet. This will support a rate of gain of 0.7 to 1 kg (1.5 to 2.0 lb) per day when properly supplemented with protein, vitamins and minerals.

Finishing Beef Cattle

Beef feedlot operators hesitant to undertake a finishing program because of a shortage of roughage or high grain and roughage prices, may well consider the results of an experiment conducted at the University of Manitoba.

Two groups of yearling steers were fed an all-grain ration (three parts barley - one part oats) during a 112 day test period. Prior to the test, a 28 day period was permitted for the steers to become adjusted gradually to the all-grain ration. An additional two groups were fed a more normal ration consisting of three parts of the above grain mixture and one part brome alfalfa hay.

Results showed that the groups provided hay gained at the rate of 1.10 kg (2.43 lb) per day as compared to 1.07 kg (2.36 lb) per day for the all-grain group. Efficiency of gain, however, was approximately six per cent higher for the grain group. No problems were encountered in either types of rations by animals going "off feed" even though the average daily feed consumption of the all-grain steers was 7.5 kg (16 lb).

Two points can be drawn from this experiment:

- Steers can be fed an all-grain ration without digestive disorders provided that an adjustment period is allowed during which hay is gradually removed from the ration.
- An all-grain ration when compared with a conventional ration, can lead to greater efficiency and economy of gain. The economy is more marked when hay prices are high.

Feedlot operators wishing to feed an all-grain ration are advised to adopt certain precautions:

- Allow at least one month for getting cattle on full grain feed.
- The grain should be rolled or very coarsely ground.
- Provide proper supplemental minerals and salt.
- Each animal should receive 20,000 I.U. of Vitamin A daily.

Many operators will feel more confident if some roughage is provided daily. For finishing beef the amount need not be large, 1-1.5 kg (2-3 lb) should be ample and the quality need not be a concern — poor quality hay or straw can be satisfactory.

The question of feeding wheat in an all-grain ration has not been answered. It does, however, appear that wheat can be fed provided it does not constitute more than one-third by weight of the grain mixture.

Note: *While the above information was based on yearlings, feeder calves may also be placed on low roughage rations. Calves, however, are more prone to digestive disorders and, as a precautionary measure, it is advisable to include 1 to 1.5 kg (2 to 3 lb) of roughage in their rations.*

Sheep

Most principles outlined for feeding low amounts of roughage to either fattening or over-wintering beef cattle can be applied to sheep flocks. Both feedlot lambs and over-wintering ewe flocks can perform well on a limited roughage intake, if adequate quantities of grain are fed, and time is allowed for sheep to adjust.

Sheep of all ages require a minimum quantity of roughage to promote rumination. When the suggested minimum of .2 kg (.5 lb) daily is fed, ewes will also require .7 to 1.5 kg (1.5 to 3 lb) of grains depending on performance of ewes and their size. Replacement ewe lambs may also be carried through the winter on a minimum of roughage. Lambs can be raised on an all concentrate diet, but most should include roughage at one quarter of the daily intake, with intake being about four percent of body weight.

For maximum lamb birth size, liveability and ewe milk production, increase the grain to 1.5 kg (3 lb) daily during the last six weeks of gestation and first six to eight weeks of lactation. Best quality roughage should be reserved for this time with daily limits increased to about 1 kg (2 lb).

If the quality of roughage used is low, or quantity limited, add protein. One management practice used is to have a grain-protein supplement (canola meal, urea) pelleted, including adequate protein, minerals (including selenium if necessary) and vitamins to adequately supplement the ewe's diet when fed at a predetermined rate (example .2 kg or .5 lb daily).

It is generally better not to roll grains for ewes and lambs over 18 kg (40 lb). Be sure that ewes and rams are in good shape prior to and during breeding. This can be achieved by grain supplementation to pasture, pasturing late seeded crops (oats, pasture rape, cereal second growth or combine aftermath, or dry lotting sheep).

Feed Processing

Grain: Feed is often the largest single cost item in livestock operations and as a result, factors influencing feed grain use affect the cost of gain and profits.

Processing of feed grains can result in improved feed efficiency. Many processing methods can improve rates of gain by 5 to 15 per cent. Dry rolling and grinding are the principle on-farm methods of grain processing. The grain kernels are fractured to increase the surface area for microbial digestion. Generally, feed efficiency is improved to 10 to 15 per cent or more when compared to feeding whole grain.

The main advantage to pelleting grain is in mechanical handling and mixing. Compared to dry rolling or grinding, pelleting grain improves feed efficiency 5 to 10 per cent. However, this is often not sufficient to compensate for the added cost.

Forage: To determine the value of grinding roughages, the individual situation must be assessed. There is little or no advantage to grinding high quality roughages, but things change as forage matures. When poorer quality roughages or straws are included in the ration, there is an advantage to grinding [1.3 cm (1/2 inch) screen or larger], both from consumption and utilization aspects as well as rates of gain. The ground roughage gains in effective feed value, but needs balancing out for proteins, vitamins, minerals and energy. When ground or finely chopped hay rations are fed, care must be taken to watch for digestive disturbances and bloat. Changes in the ration must be made gradually.

Limiting Grain Intake With Salt

Feeding grain to cattle on pasture can be an effective way to extend feed supplies. Self-feeding of supplements allows timid, slow-eating animals to get their share.

One management tool frequently used to reduce labor is regulating grain intake with salt. Salt is not a perfect regulator of supplement intake since certain animals will tolerate more salt than others. However, there are practical limits to the amount of salt cattle can eat and it can be used to effectively restrict consumption of a free-choice supplement.

Salt intake will be affected by forage intake, palatability of the supplement, salt content of water and forage, and adaptation to salt. Usually it is necessary to increase the salt content of the mix over a period of time as cattle become accustomed to a high salt level. Cattle tend to consume more of a salt-limited supplement when forage is scarce or unpalatable. Extra precautions should be taken under these and other emergency conditions to ensure that water supplies are adequate. As a rule of thumb, cattle on salt mixtures drink 50 to 75 per cent more water than normal or approximately five gallons of additional water for each pound of salt.

Provided ample water is available, salt toxicity is seldom seen in cattle because of their high tolerance for salt. The one-time lethal dose for mature cattle is 1.8 to 2.3 kg (4 to 5 lb) of salt.

Tables 1 and 2 can be used to estimate the percentage of salt needed to restrict consumption of a free-choice supplement.

Table 1. Estimated Salt Intake of Cattle Fed Salt-Limited Supplements

ANIMAL WT.		CONSUMPTION / DAY			
		Average		Range	
kg	(lb)	grams	(lb)	grams	(lb)
136	300	227	0.5	136-272	0.3-0.6
227	500	272	0.6	227-318	0.5-0.7
318	700	318	0.7	272-409	0.6-0.9
409	900	409	0.9	318-500	0.7-1.1
500	1100	500	1.1	364-591	0.8-1.3
591	1300	591	1.3	409-682	0.9-1.5

Find the expected daily intake of salt in Table 1. Then, locate this in the left column of Table 2. Read across Table 2 to find the pounds of non-salt feed closest to what you would like. At the top of that column will be the per cent salt needed in the total supplement mixture.

Table 2. Daily Feed Consumption Expected with Various Salt Concentrations

SALT INTAKE/DAY				SALT IN SUPPLEMENT				
grams	(lb)			12%	16%	20%	30%	40%
227	0.5	Total Feed	kg	1.9	1.4	1.1	0.7	0.5
			(lb)	4.2	3.1	2.5	1.7	1.2
		Nonsalt Feed	kg	1.7	1.2	0.9	0.5	0.3
			(lb)	3.7	2.6	2.0	1.2	0.7
272	0.6	Total Feed	kg	2.3	1.7	1.4	0.9	0.7
			(lb)	5.0	3.8	3.0	2.0	1.5
		Nonsalt Feed	kg	2.0	1.5	1.1	0.6	0.4
			(lb)	4.4	3.2	2.4	1.4	0.9
318	0.7	Total Feed	kg	2.6	2.0	1.6	1.1	0.8
			(lb)	5.8	4.4	3.5	2.3	1.7
		Nonsalt Feed	kg	2.3	1.7	1.3	0.7	0.5
			(lb)	5.1	3.7	2.8	1.6	1.1
409	0.9	Total Feed	kg	3.4	2.5	2.1	1.4	1.0
			(lb)	7.5	5.6	4.5	3.0	2.2
		Nonsalt Feed	kg	3.0	2.1	1.6	1.0	0.6
			(lb)	6.6	4.7	3.6	2.1	1.3
500	1.1	Total Feed	kg	4.2	3.1	2.5	1.7	1.2
			(lb)	9.2	6.9	5.5	3.7	2.7
		Nonsalt Feed	kg	3.7	2.6	2.0	1.2	0.7
			(lb)	8.1	5.8	4.4	2.6	1.6
591	1.3	Total Feed	kg	4.9	3.7	3.0	2.0	1.5
			(lb)	10.8	8.1	6.5	4.3	3.2
		Nonsalt Feed	kg	4.3	3.1	2.4	1.4	0.9
			(lb)	9.5	6.8	5.2	3.0	1.9

If a grain supplement is to be fed at the rate of 2.7 kg (6 lb) per day to a group of 500 kg (1100 lb) cows: Table 1 indicates that the daily salt consumption of 500 kg (1100 lb) cattle averages 500 grams (1.1 lb) when salt is used to limit supplement intake. In the left hand column of Table 2, locate 500 gm (1.1 lb) daily salt intake and look across the row labelled non-salt feed for a value nearest 2.7 kg (6 lb). In this example, a self-fed supplement composed of 16 per cent salt and 84 per cent grain would, on the average, regulate total intake to 2.7 kg (6 lb) grain and 500 gm (1.1 lb) salt. These percentages may need slight adjustment to achieve the desired feed intake.

Salt used in self-fed supplements should be coarse, plain white salt. Do not use trace mineralized salt since force feeding high levels of it could result in toxicity or mineral imbalances due to excessive intake of certain trace elements. If trace mineralized salt is required by cattle, the amount consumed daily should not exceed 0.02 per cent of the animal's body weight.

For cattle accustomed to eating supplements but not to self-feeding, overeating can be prevented by starting with a high salt level (50:50 or 60:40 salt to meal). Then reduce salt levels to obtain desired level of intake. If cattle have not eaten concentrates before, a training period of a week or more of daily hand feeding supplement without salt may be necessary, especially with young cattle. Follow these precautions:

- Have plenty of clean water available.
- Grain should be coarsely ground or cracked and mixed with salt of similar particle size to prevent separation and overeating.
- Have adequate grass or hay available so that cattle are not forced to eat the supplement.
- Use coarse, plain white salt in the mixture.

Note: *The above figures do not apply if Rumensin is included in the mixture, since it also limits consumption.*

Buying Feed

The basic question when purchasing feed is how to get the greatest nutritional benefit for the money spent. *Under conditions where minimum quantities of roughage are fed to cattle and sheep,* the approximate feeding values developed by Dr. Frank Whiting of Agriculture Canada apply (see table 3).

Pricing Silage and Haylage: Since silage has no commercial market, pricing is left to you and your neighbor. University of Wisconsin economists have developed a table which makes pricing easier (see table 4). Figures were prepared using this equation:

$$\frac{\%\ \text{DM in haylage}}{\%\ \text{DM in baled hay}} \times \text{Price of baled hay} = \text{Price of haylage}$$

Table 3. Buying Feed

Med. Quality Grass Hay 6 to 7% Protein 1	Legume 2	Oat Straw 3	Wheat Straw 4	Refuse 5	Wheat[2] Grain 6	Barley[2] Grain 7	Oat[2] Grain 8
45.00	52.50	37.50	26.30	60.00	2.25	1.80	1.27
50.00	58.30	41.70	29.20	66.70	2.50	2.00	1.42
55.00	64.15	45.85	32.10	73.40	2.75	2.20	1.56
60.00	70.00	50.00	35.00	80.00	3.00	2.40	1.70
65.00	75.80	54.20	37.95	86.70	3.25	2.60	1.85
70.00	81.60	58.40	40.90	93.40	3.50	2.80	1.99
75.00	87.50	62.55	43.80	100.00	3.75	3.00	2.13
80.00	93.30	66.70	46.70	106.70	4.00	3.20	2.27
85.00	99.10	70.90	49.65	113.40	4.25	3.40	2.41
Comparative value[1]							
60	70	50	35	80	100	100	100

[1] As an example of comparative value, this table shows that good quality oat straw has 50 per cent of the feed value of wheat, barley or oats. Oat straw at $50.00/ton is comparable to barley at $2.40/bushel or $\frac{2205\ \text{(lb/tonne)}}{48\ \text{(bu. wt. of barley)}} \times 2.40 = \$110.25$/tonne. Oat straw at $50/ton is comparable to wheat at $3/bushel or $\frac{2205}{60} \times 3 = \$110.25$/tonne and oats at $1.70/bushel or $\frac{2205}{34} \times 1.70 = \$110.25$/tonne.

[2] Values are similar when oats make up no more than 30 per cent or wheat not more than 50 per cent of a finishing ration for beef.

Table 4. Price of Haylage Per Ton (As-Is Basis) Based on the Price of Baled Hay

Price of Baled Hay ($/ton)	PER CENT MOISTURE IN HAYLAGE								
	44	46	48	50	52	54	56	58	60
40	24.89	24.00	23.11	22.22	21.33	20.44	19.56	18.67	17.78
41	25.51	24.60	23.69	22.78	21.87	20.96	20.04	19.13	18.22
42	26.13	25.20	24.27	23.33	22.40	21.47	20.53	19.60	18.67
43	26.76	25.89	24.84	23.89	22.93	21.98	21.02	20.07	19.11
44	27.38	26.40	25.42	24.44	23.47	22.49	21.51	20.53	19.56
45	28.00	27.00	26.00	25.00	24.00	23.00	22.00	21.00	20.00
46	28.62	27.60	26.58	25.56	24.53	23.51	22.49	21.47	20.44
47	29.24	28.20	27.16	26.11	25.07	24.02	22.98	21.93	20.89
48	29.87	28.80	27.73	26.67	25.60	24.53	23.47	22.40	21.33
49	30.49	29.40	28.31	27.22	26.13	25.04	23.96	22.87	21.78
50	31.11	30.00	28.89	27.78	26.67	25.56	24.44	23.33	22.22
51	31.73	30.60	29.42	28.33	27.18	26.06	24.88	23.79	22.64
52	32.34	31.20	30.00	28.88	27.72	26.57	25.38	24.26	23.08
53	32.96	31.80	30.58	29.44	28.25	27.08	25.86	24.73	23.53
54	33.59	32.40	31.15	29.99	28.78	27.59	26.35	25.19	23.98
55	34.21	33.00	31.74	30.55	29.31	28.11	26.84	25.66	24.42
56	34.83	33.60	32.31	31.11	29.85	28.62	27.33	26.13	24.86
57	35.45	34.20	32.89	31.66	30.38	29.13	27.82	26.59	25.31
58	36.08	34.80	33.47	32.19	30.91	29.64	28.30	27.06	25.75
59	36.70	35.40	34.04	32.77	31.45	30.15	28.79	27.53	26.20
60	37.32	36.00	34.62	33.33	31.98	30.66	29.28	27.99	26.64
61	37.94	36.60	35.20	33.88	32.51	31.17	29.77	28.46	27.08
62	38.56	37.20	35.77	34.44	33.05	31.68	30.26	28.93	27.53
63	39.18	37.80	36.35	34.99	33.58	32.19	30.74	29.39	27.97
64	39.80	38.40	36.93	35.55	34.11	32.71	31.23	29.86	28.42
65	40.43	39.00	37.50	36.11	34.65	33.22	31.72	30.33	28.86
66	41.05	39.60	38.08	36.66	35.18	33.73	32.21	30.79	29.30
67	41.67	40.20	38.66	37.22	35.71	34.24	32.70	31.26	29.75
68	42.30	40.80	39.24	37.77	36.24	34.75	33.18	31.73	30.19
69	42.91	41.40	39.81	38.33	36.78	35.26	33.67	32.19	30.64
70	43.54	42.00	40.39	38.88	37.31	35.77	34.16	32.66	31.08

Examples: Suppose baled hay is selling locally for $40 per ton, but you would rather buy your neighbor's 48 per cent moisture haylage. What should you pay?

1. Subtract 48 from 100 to find dry matter (DM) content of 52 per cent.
2. Plug in a 90 per cent dry matter level for baled hay (this is constant).
3. Divide and multiply.

$$\frac{.52}{.90} \times \$40 = \$23.11 \text{ per ton}$$

So, with $40 per ton hay, you can spend up to $23.11 per ton for haylage provided that the feeding quality of the hay and silage are equal.

Problem Feeds

Frozen Grain: Low in energy, but not toxic.

Sprouted Grain: Sprouting lowers the yield, bushel weight, and energy content but the grain is not harmful to livestock.

Mouldy Feeds: Mould growth, accompanied by heating, takes place in most feeds when their moisture content is above 15 or 16 per cent for a period of time. The presence of mould does not necessarily mean that the feed can not be used. Most moulds are not toxic when fed to livestock. However, some moulds are very toxic and dangerous. Producers should be aware of the possible dangers and recognize steps to take to minimize risk.

Moulds in feeds (both hay and grain) can cause problems for two reasons. Many moulds are known to produce one or more toxins, some of which cannot be identified at present. Many of these toxins can cause severe upset and abnormality even when present in very small amounts. Symptoms vary with the particular mould and toxin. However, it helps to remember that cattle are more resistant to mould toxins than either swine or poultry. Young animals are more susceptible than mature animals, and pregnant or lactating animals are especially susceptible.

The second cause of problems are the mould spores. When inhaled, the spores can cause the lungs to become abnormally sensitive to these particular spores. Chronic respiratory disease and even death can occur if exposure to the mouldy feedstuff is continued. The spores are doubly dangerous because farmers can develop a sensitivity known as Farmers Lung. Symptoms appear four to eight hours after exposure to spores, and can include headache, loss of appetite, fever and chills. Body temperature may rise to 41°C. There are varying degrees of shortness of breath along with a dry, hacking cough. Although other symptoms subside quickly, breathlessness may persist for several weeks, improving slowly. Continued exposure can lead to irreversible lung damage. People vary in susceptibility. At present, the only real cure for Farmers Lung is to keep away from the mould responsible.

Mouldy feeds may mean trouble, but the risks can be minimized by smart management. If mouldy hay, grain, or concentrate is to be fed, observe the following precautions:

1. Send a representative sample of the feed to the Provincial Feed Testing Laboratory for mould analysis. Grain samples should not be ground or rolled. The procedure takes two to four weeks, as a culture of the mould must be grown before examination to indicate if the mould involved produces toxins.
2. Gradually introduce mouldy feeds into the ration. This does several things. Mouldy hay is unpalatable, and many problems attributed to mould are actually caused by malnutrition. It takes cattle a few days to adjust to the poor taste and dust; some cattle never adjust. Also, any toxicity problems should not be as severe if the mouldy hay is introduced gradually.
3. Balance mouldy feeds with good quality ingredients.
4. If problems are encountered, stop using the mouldy feed and seek help from a competent source.
5. Never feed mouldy sweet clover hay or silage (see below).
6. If possible, avoid feeding mouldy feeds to young, milking or gestating animals. These classes of animals are all particularly susceptible to problems caused by mould.
7. Feed mouldy hay outside so as to reduce the effects of dust and spores on the respiratory system.
8. Producers should be aware of the health hazard involved in working with mouldy feeds and take every precaution to decrease personal exposure.

Mouldy Silage:— may cause problems similar to mouldy hay. Breeding ewes fed mouldy peavine silage may have lambs which develop muscular incoordination.

Red Clover:— a mould that causes black patch, a disease of red clover, also produces excessive salivation (slobbering) when infected hay is fed to cattle. After two or three days the cattle will stop eating this spoiled hay. The chemical causing the trouble is an alkaloid and the hay should be destroyed.

Sweet Clover Poisoning: Poorly preserved sweet clover hay or silage is a major cause of death of livestock each year in Manitoba. These fatalities are unnecessary and can be prevented by proper management.

A substance, coumarin, is present in varying amounts in all sweet clover. However, two new varieties, Norgold and Polara have a very low coumarin content and do not pose a problem.

In poorly preserved sweet clover hay or silage from common seed or other varieties, coumarin may change to dicoumarol, a potent anti-coagulent. When eaten by farm livestock, dicoumarol causes the blood to lose its normal ability to clot. Livestock may bleed to death from the slightest injury, either internally or externally.

The first sign of sweet clover poisoning may be the death of one or more animals. Warning signs include stiffness, lameness, dull attitude and swellings beneath the skin over all parts of the body, but primarily at the hips, legs, brisket or neck. Blood may be present in the feces, urine or milk and also the nostrils.

Control

There is no laboratory test for dicoumarol available in Manitoba. Producers feeding sweet clover should observe the following management practices:

- Feed sweet clover for 7 to 10 days and then completely replace it with another forage for 7 to 10 days. It is important that the animals be taken off sweet clover completely for the 7 to 10 days to give the body time to recover.
- Do not feed sweet clover for at least two weeks and preferably four weeks before calving and during the calving period.
- Avoid surgery (dehorning, castration, etc.) on animals consuming sweet clover.
- Make sure animals have proper mineral supplementation.
- If a problem does develop or is suspected, contact your veterinarian immediately.

Nitrate Poisoning

High levels of nitrate in feed need not be a problem if the producer is aware of the fact and manages the feeding program accordingly.

Nitrates generally build up in young plants subjected to stress conditions such as drought, hail, disease, frost or spray drift. Although high nitrate levels are generally associated with frosted green oats, high levels can also be found in wheat, barley, rye, corn, sorghum, sudan grass and numerous weeds. Seeds do not appear to accumulate nitrate nitrogen.

Nitrates in the feed are converted during digestion to nitrite, a much more toxic form. When this is absorbed into the blood, the bloods' oxygen carrying capacity is reduced, with the animal's death being comparable to asphyxiation.

A dangerous quantity of nitrate in forage can be detected only by chemical analysis. Any amount of nitrate nitrogen over 0.5 per cent of the total ration (on a moisture-free basis) is regarded as a potential source of trouble.

The signs of nitrate poisoning appear suddenly. Rapid and weak heart beat, body temperature below normal and muscular weakness develop quickly. The animal may die in convulsions within an hour, but normally death results after three to four hours. Most animals that show signs but live, fully recover within 10 to 14 days. Pregnant females frequently abort following recovery from nitrate poisoning. Low daily intake of nitrate apparently causes no evidence of disease.

Control: Nitrate poisoning can be controlled by management. If you suspect your feed may be high in nitrates, have it analyzed **before** feeding. High nitrate forages can be mixed with low nitrate level forages, reducing the overall toxicity of the ration. Feeding adequate levels of energy and Vitamin A reduces the risk of nitrate toxicity. Ensiling forage tends to result in a 40 to 60 per cent reduction in nitrate level, as fermentation reduces some of the nitrates to gas.

Note: *When nitrate troubles are suspected, consult your veterinarian or agricultural representative.*

Prussic Acid Poisoning

Under certain conditions some plants cause the death of stock from prussic acid, or hydrocyanic acid poisoning. Two native species, arrowgrass and chokecherry and two cultivated plants, flax and the sorghum - sudan grass crops, all common to many areas of Canada — may contain toxic quantities of prussic acid. Because arrowgrass also contains a fairly high salt concentration it is often eaten by salt-deficient cattle and sheep. Chokecherry leaves are not very palatable, but when normal feed is sparse cattle will eat them.

Flax and sorghum-sudans in the early vegetative stage and/or stunted by drought or frost may contain toxic quantities of prussic acid. The effect of the toxin may be reduced when plants are cured as hay or stored for several weeks as silage.

Stock affected by the poison often die a few minutes after eating only a small quantity of the dangerous forage. Normally, animals stagger and struggle before they go down. There is salivation and a gradual increase in the respiratory rate. Death from respiratory paralysis occurs during severe convulsions and the animal usually dies within 30 to 45 minutes. Most animals that live for two hours after the onset of signs will recover. Horses are rarely affected.

If a poisoned animal is discovered, call a veterinarian. Should there be any doubt at all about the safety of feed, have it tested for prussic acid levels at the Provincial Feed Analysis Laboratory.

Ergot

Ergot bodies have the same general shape as the seed but they are larger, purple to black in color, and hard. They are caused by a fungus which replaces individual seeds or kernels on the head of the plant. Although it is most common in rye, ergot also infects triticale, wheat, barley, oats, and grasses such as wheat grass, quack grass, smooth brome, wild rye and blue grasses. Ergot is most prevalent during wet seasons and may be present in greater concentrations near the edge of a field than in the center.

Ergotized seed may cause serious problems for animals when consumed in either forage or grain. Ergot causes two types of poisoning. One form causes convulsions, staggering, muscle spasms of the hind legs and sometimes temporary paralysis. This form of ergotism is usually found in sheep, horses and carnivores but seldom in cattle.

The second, or gangrenous, form of ergotism causes lameness that may be followed by the loss of the end of the tail, ears and perhaps hooves. Loss of these parts is due to a dry form of gangrene caused by impaired circulation and reduced blood supply to the body's extremities. This form of ergotism occurs in cattle and pigs. It may take two weeks to three months for symptoms to develop. In the meantime, rate of gain, milk production, and reproduction suffer. Sows fed ergot generally have their litter but no milk.

Research is not exacting in regard to tolerance levels. The problems with ergot are caused by alkaloids in the ergot body. These alkaloids vary in toxicity. Therefore, ergot bodies vary in toxicity depending on the amount and type of alkaloid they contain. No practical test has been devised to determine the toxicity of ergot samples.

Generally speaking, if grain contains more than 0.1 per cent ergot (10 ergot bodies per litre of grain) it should not be fed to livestock. If more ergot is present, contaminated grain can be mixed with clean grain to reduce the concentration. Grain infected with any amount of ergot should never be fed to pregnant or lactating animals.

For further information, see Agriculture Canada Publication #1438, *Ergot of Grains and Grasses.*

Oxalic Acid in Beet Tops

Beet tops contain about one per cent soluble oxalates which are unlikely to be detrimental to cattle or sheep if fed as recommended. Poorly fed animals seem to be more susceptible to oxalic acid poisoning than those that are well fed. See *Beet Tops* for more information.

Chemical Residue Danger

Residues on chemically treated fields can harm livestock feeding on green crops or straw. This table summarizes label restrictions for herbicides recommended for cereal or forage crops. Consult product labels for specific information and for other crops.

PRODUCT	RESTRICTION
Afolan F/Lorox	Do not graze or feed green plants to livestock.
Amitrol T	Do not graze until six months following treatment.
Avadex BW	*Cereals* none. *Forage legumes* Do not harvest as forage in the year of seeding.
Avenge 200 C	Do not graze or feed cereals for eight weeks after treatment. Do not graze or harvest forage grasses or legumes for forage in the year of treatment.
Banvel	*Cereals* Do not graze or harvest for livestock feed prior to crop maturity. *Pasture and forages* Do not graze or feed *dairy animals* within seven to 60 days of treatment, depending on rate of Banvel applied. See product label for additional detail. Do not graze or feed *slaughter animals* within 30 days of treatment. Forage harvested within 30 days of treatment should not be fed to slaughter animals within 30 days of slaughter. There is no restriction for livestock other than dairy or slaughter animals.
Basagran	None.
Basfapon/Dowpon	Do not feed first year cuttings to dairy animals or animals being finished for slaughter.
Blagal	Do not graze or feed green plants to livestock.
Buctril M/ Pardner/Sabre/Torch DS	None, except with Torch DS on forages. Do not graze or harvest forage grasses for feed in the year of treatment with Torch DS.
DyVel	Do not graze or harvest for livestock feed prior to crop maturity.
Edge DF	None.
Embutox 625/Tropotox Plus/Cobutox/2,4-D Butyric 400	None.
Eptam	None.
Fusilade	Do not graze or harvest for livestock feed in the year of treatment.
Hoe-Grass 284	Do not graze treated cereal crops. Straw can be used for bedding or feed after harvest of the crop. Do not graze treated forages.
Hoe-Grass II	Do not graze treated fields prior to harvest.
Kerb	Do not harvest or graze within 60 days after application.

PRODUCT	RESTRICTION
Kil-Mor	Do not graze or use for livestock feed within seven days of application.
Lexone/Sencor	Do not graze or feed treated cereal crops within 30 days of application, or peas within 70 days after application.
Lontrel	Do not graze or feed crops treated with Lontrel.
Mataven/Mataven L	Do not graze or feed treated wheat before maturity. Straw can be used for bedding or feed after harvest of the crop. Do not graze or harvest forage grasses or legumes for feed in the year of treatment.
MCPA	Do not graze dairy cattle within seven days of spraying.
MCPP	None.
Poast	Do not graze treated fields or harvest for feed prior to crop maturity.
Princep Nine-T/Simazine	Do not graze for 30 days or cut for hay within 60 days of application.
Reglone	There are no restrictions for feeding forage treated with Reglone to animals.
Rival/Treflan/Triflurex	None.
Roundup	Do not graze or harvest treated areas until treated plants have turned brown and started to deteriorate.
Sinbar	None.
Stampede/Stampede CM	None.
Target	Do not graze or use for livestock feed within seven days of application.
TCA	Do not graze treated areas for at least 24 hours.
Tordon 202 C	Do not feed treated plant material to meat animals being finished for slaughter, or to dairy animals within 14 days of treatment. See label for precautions on use of manure when treated crop is fed.
2,4-D	Do not graze for 24 hours after treatment.

Terms Used in Nutrition

Moisture Content — as related to actual nutrient content of feeds.

Dry Matter — a method of expressing the level of nutrients in a feed on the basis that the feed contains no moisture. This allows accurate comparison of feeds of widely different moisture content such as hay and silage.

$$\% \text{ nutrient in dry matter} = \% \text{ nutrient as fed} \times \frac{100}{\% \text{ dry matter in feed}}$$

As Fed — refers to the per cent dry matter of the feed as consumed by the animal.

e.g. silage — 30-45% dry matter as fed
hay — 85-90% dry matter as fed

$$\% \text{ nutrient as fed} = \frac{\% \text{ nutrient basis 100\% dry matter} \times \% \text{ dry matter in feed}}{100}$$

Note: Nutrient content of commercial feeds are provided on an AS FED basis.

Total Digestible Nutrients — a figure which indicates the relative energy value of a feed to an animal. It is the sum of the digestible protein, digestible carbohydrates and (digestible fat x 2.25). In forages it is estimated from chemical feed analysis and is largely based on % fiber in the feed. Since fiber provides little nutrient value, TDN decreases as fiber level increases.

Essential Nutrients — substances which must be provided to the body in order for it to stay alive. There are five essential nutrients:

Energy — provides the body with the capacity to produce heat and utilize other nutrients in growth, reproduction, milk production and fattening. Commonly expressed as TDN or digestible energy (DE). One kg TDN = 4,400 kcal of DE.

Protein — especially important for and during growth. Made up of 'amino acids' which are nitrogen containing compounds that constitute the 'building blocks' from which proteins are made.
Urea in properly formulated rations can be used by rumen organisms as a source of nitrogen to produce protein.

Minerals — the 'ash' left after burning the feed under intense heat. Calcium and phosphorus are the minerals present in greatest amounts in the body. When buying mineral supplements, the first number generally refers to calcium and the second number to phosphorus. Thus, a 20:10 mineral supplement would contain 20% calcium and 10% phosphorus and be referred to as a 2:1 mineral mix.

Vitamins — substances which in relatively small amounts are essential for life. The fat soluble vitamins (A,D,E,K) can be stored by the body. Vitamins A, D, E must be provided. Ruminants can synthesize all other necessary vitamins.

Water — the most essential nutrient in terms of immediate body health.

Crude Fiber — refers to the portion of the feed which is largely unavailable to the animal. It primarily includes cellulose, certain hemicelluloses and lignin.